UNITED STATES
DEPARTMENT OF THE INTERIOR
SOIL EROSION SERVICE

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SOIL EROSION SERVICE

UNITED STATES DEPARTMENT OF THE INTERIOR

ELM CREEK WATERSHED--CENTRAL TEXAS

NEWS LETTER----------NO. 6

TEMPLE, TEXAS. NOVEMBER, 1934.

INVESTMENT IN BRAZOS FLOOD CONTROL PROGRAM MUST BE SAFEGUARDED!

By Dr. H.V. Geib,
Regional Director,
Soil Erosion Service,
U.S. Department of the Interior.

From Temple Telegram - - 11/15/34

Good fishing for central Texas! Abundant duck shooting! Boating, swimming, camping---a real attraction for tourists; in fact, a Paradise for lovers of outdoor life.

These are the visions that flash through the mind of the average layman when the Brazos River Flood Control Project is mentioned. The more serious minded individuals consider the economic possibilities of such a plan. They see an abundant water supply for city use, for irrigation, and for the development of electricity for power and light.

Those living on the lower lands bordering the main waterways rejoice at the thought of security from periodic floods and the assurance that their fertile bottom lands will at last become a real asset.

A Paying Proposition

But before the federal government will approve this project and agree to loan the necessary funds for its development, there must be convincing evidence that the proposition if financially sound.

To meet this requirement the engineers have presented figures to prove that the enterprise will be self-liquidating--that enough revenue will be obtained from the sale of water and power rights to pay the interest on the loan, gradually retire the principal, and maintain the whole system in first class working condition.

Must Be Permanent

There appears to be only one serious error in the calculations so far presented. The engineers have determined the capacities of the numerous reservoirs that are to be built and have assumed that these capacities will remain the same for several hundred years and that the same revenue can be depended upon---year after year. In this contention they have seemingly failed to take into consideration what is happening to other more or less similar undertakings. Or, if they have given the matter consideration, they have neglected to make adequate provisions for it, in their request for funds.

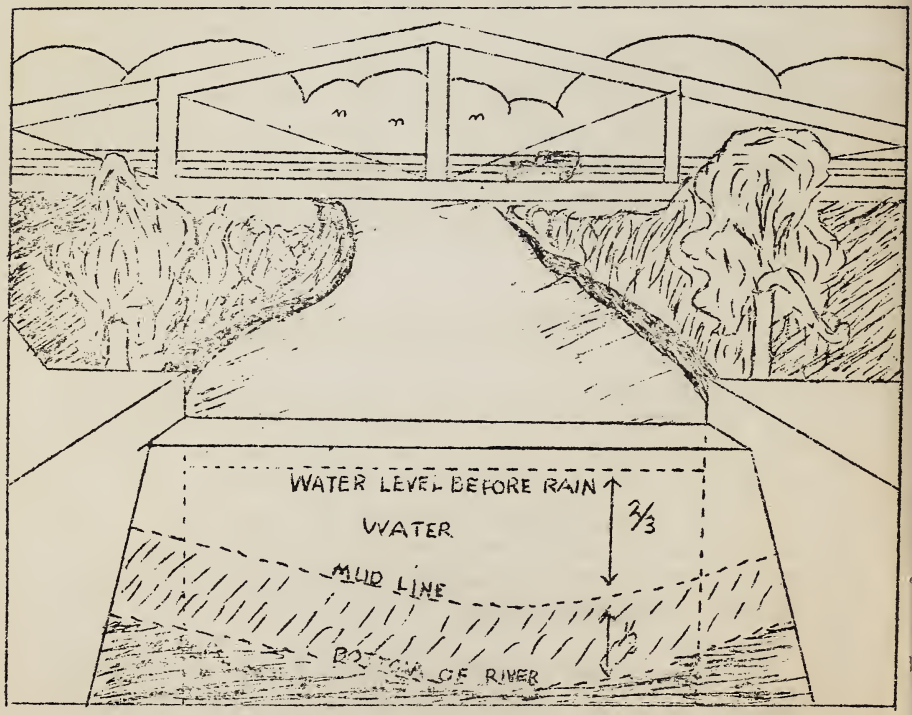
Silting of Reservoirs.

Investigations show that a great number of the country's larger dams, which were built for the sole purpose of impounding water, are also catching soil at a very alarming rate. The space in these reservoirs occupied by mud means a proportionate loss in water-holding capacity, and therefore in revenue-producing power and flood control possibilities.

Measurements taken at the large Roosevelt Dam in Arizona show that the tremendous reservoir is already one third full of silt.

Coming nearer home, we have an opportunity to witness first hand, what is happening in this regard. The dam in the Colorado River at Austin, Texas has already caught so much silt that the storage capacity of the reservoir is almost entirely destroyed.

The lake at Rogers, Texas, catches the drainage from only about 330 acres. Yet each year enough mud accumulates in this lake to cover an acre of land, four feet deep. In the comparatively few years since the dam was built in the Leon River, impounding the water for the use of the city of Temple, the storage capacity has been reduced approximately 1/3 by silting. See drawing below:



"LEON RIVER DAM"

Showing silting of Temple water supply reservoir.

Is it any wonder that we worry about a water shortage in long drought periods!

In another ten years, if nothing is done about it, a four-month's drought will leave Temple without water.

The Farmer's Loss

And from whence cometh all of this silt. Ask the farmers, who are trying to eke out a living by raising crops on subsoil land,--whose average yield of cotton has decreased to half, and in many cases to less than a fifth of what it was when they were farming the top-soil.

Their loss, and the continued loss to their children and their children's children is immeasurably greater and vastly more important than the mere silting of reservoirs and the endangering of a city's water supply.

Silting Can Be Stopped

It has been definitely proven that silting can be very largely controlled by putting into effect an efficient erosion control program over the entire watershed. Such a system would include not only terracing, but the wide use of erosion resisting vegetation. Such vegetation is nature's own method of holding the soil, but man has been slow to take advantage of this fact.

Steep slopes should not be cultivated, but should be planted to grass or to timber. Crops should be planted on the contours, strips of dense growing crops alternated with strips of row crops, and farming systems changed so that soil washing will be checked to as great an extent as possible.

The government is coming to realize the menace of silting, and on one of its late projects, the control of floods in the Muskingum River Watershed, in Ohio, studies are being made of the best possible means of checking erosion, and thus protecting the reservoirs that are to be built. It is obvious that this is a wise precaution.

Permanency Imperative

And so, when plans are presented to Congress to spend millions upon millions of dollars for the erection of dams for the impounding the flood waters of the Brazos Watershed let us hope and pray,--let us do more,--let us insist that provisions are included which will guarantee the permanency of the project, and safeguard the investment of the allotted funds, and at the same time give protection to the farm lands of the watershed,--thus assuring a healthy continuance of the greatest and most important and basic industry of the world.

MAINTAINING SOIL FERTILITY

by

TERRACING - STRIP CROPPING - GREEN MANURE CROPS - BARNYARD MANURE

The Wonderful Increase

The power of nature to cause plant growth is strange and difficult to understand. We plant 10 lbs. of corn and harvest 2000 or more lbs. We plant 24 lbs. of cotton seed and produce 700 lbs., and with 60 lbs. of beans or peas we harvest 20,000 lbs.

How little we give! How much nature returns!

What the Soil Contains

Soil contains water, air, organic matter, bacteria and rock particles. Water dissolves, contains and conveys plant food. Air contains plant food, and is necessary for growth of soil bacteria, seed germination and root growth. Organic matter improves the tilth and aeration of the soil, increases water holding capacity, contains plant food and increases the amount of available plant food. Bacteria break down organic matter and make plant food available. Rock particles are a source of mineral plant food elements.

Factors Limiting Crop Yields.

Why do some soils yield large crops, and some soils yield small crops? We say the land is rich, or the land is poor. All plants and animals require food to live and grow. There are about 10 plant food elements necessary for plant growth. Soil may contain plenty of all plant foods but one, and not grow good crops. Production is limited to the shortest plant

food available to the plant.

Of the 10 plant food elements, however, only three need be of concern to the farmer, as most soils have enough of the other plant foods available. These three important plant foods are Nitrogen, Phosphoric acid and Potash. Of the three, Nitrogen is the most important limiting factor in crop production. It is more unstable than the others as is easily leaches out of the soil, washes away or escapes as gas. Phosphoric acid is next in importance and, although it does not leach out or get away in gas, it goes into chemical combinations which keeps a portion of it in a form which is unavailable to the plant. Potash leaches very little and is lost only from the soil by surface washing. In our blackland, Potash is not as limiting a factor as the other two.

Humus, or organic matter, is an important factor to be considered with all soils. We have already stated that organic matter increases the water holding capacity and the amount of available plant food in the soil as it aerates the soil and keeps it in condition so that bacteria can grow. Bacteria are important because they change unavailable plant food into a form which can be used by the plant, so it is necessary that the soil be kept in a good physical condition so the bacteria or germs can grow and multiply and work for us. Proper drainage and the control of excess water on the land is a very important factor. As already stated, water dissolves, conveys and contains plant food, and without it the food would not be available to the plant. It is then necessary that rolling land be terraced or strip-cropped, or both, in order to hold the water on the land as long as possible,

as well as to prevent soil and plant food loss. Excess, or uncontrolled water running off the land will carry away 20 times as much plant food as is needed to produce a crop, and from 20 to 50 tons, or more, of soil per acre annually.

Plant Food Removed by Crops

We have stated that three of the ten elements of plant food are very important. Following is a table showing how many lbs. of Nitrogen, Phosphoric acid, and Potash are removed from the soil by the three major crops grown in the blackland, when they are harvested and sold off the farm.

Crop	Quantity	Plant Food Removed		
		Nitrogen	Phos.	Potash
Cotton	300 lbs. lint	42 lbs.	13 lbs.	35 lbs.
Corn	40 bushels	55 lbs.	27 lbs.	45 lbs.
Oats	50 bushels	50 lbs.	18 lbs.	47 lbs.

Nitrogen is necessary for leaf, stem and stalk growth. Phosphoric acid stimulates early root development, gives a vigorous start to plants, increases the ratio of fruit to stalk, improves the quality of the fruit and hastens maturity of the crop. Potash is important in the promotion of certain plant foods, gives stiffness to the stalk, helps plants to resist disease and improves the quality of the fruit.

The Income and the Outgo

There is a continual income and outgo of plant food on the farm, but unless the farmer adheres to certain practices the outgo greatly outweighs the income.

Plant food must be returned to the soil in the amount in which it is taken out in order to maintain the fertility of the soil--the income, in other words, must equal the outgo. The income is derived from several sources. Nitrogen from the air through leguminous plants grown on the land, rain which carries a small amount of plant food from the air into the soil, vegetable matter turned under--barnyard manure, commercial fertilizers, and mineral deposits in the soil. The outgo occurs by sending crops to market, animal products to market, loss from manure by failure to collect and put back on the land, certain chemical changes in plant food (oxidation and dentrification), erosion and leaching.

Maintaining Fertility in the Blackland.

Summarizing information already given, it is evident that the farmer, in order to maintain the fertility of the soil, must control water on rolling land by terracing and strip-cropping so there will be no loss of soil, and must return to the land as much plant food as is used by the crop taken off the land and marketed.

The blackland does not respond well to commercial fertilizers, so it is necessary to use green manures and barnyard manure to furnish humus and plant food and to improve the physical condition of the soil.

Legumes are soil builders. Legume plants are the best to use as a green manure crop because they have the ability to obtain nitrogen from the air. With the aid of bacteria growing in nodules on the roots, the nitrogen is taken from the air and fixed in the plants. If the plant is turned under there is an increase

of nitrogen in the soil. About two thirds of the nitrogen is in the plant above the ground and one third in the roots. If the legume is cut for hay, then only one third of the nitrogen in the plant is left in the soil.

Peas, beans, clover, vetches and alfalfa are all legumes. Oats, corn, rye, barley, wheat and other grain crops are non-legumes. Legumes are susceptible to the cotton-root-rot disease and will therefore die where cotton will die. Winter legumes, however, can be grown without much danger of dying. The Soil Erosion Service is furnishing enough Hairy Winter Vetch, Austrian Winter Peas or Hubam to farmers who are strip-cropping to plant 3 to 5 acres, which will give them a start in these valuable legumes. If the seed is harvested they should have enough to plant a larger acreage the next year. The Soil Erosion Service requires only that the farmer return, after harvest, the amount of seed given him.

Crop rotation is important. Crop rotation is considered a vital part of today's plan of farming. The chief purpose of rotation is to increase the nitrogen and humus in the soil, and for that reason any crop rotation plan should include a legume. Turning under a good crop of legumes will restore, per acre, from 40 to 60 lbs. of nitrogen to the soil. Referring to the figures in the chart, it is noted that this is more nitrogen than is required to produce a crop of cotton, corn or oats. It must be remembered, however, that nitrogen is unstable and some will be lost by erosion, leaching and dentrification.

Barnyard manure valuable. All available barnyard manure should be put back on the land. Most of the substance of barnyard manure is or-

ganic matter, and it must be remembered that organic matter, or humus, is very important. Nevertheless, 40 percent of the plant food value of manure is usually lost through improper care and from fermenting and leaching. Nitrogen is lost in the form of ammonia gas caused by fermenting. Plant food is also lost through leaching when exposed to rain. Manure should be kept piled and under cover so that it will not dry out. It is probably that the beneficial influence of organic matter of manure is fully as great as its plant food value, because, as pointed out before, it improves the tilth of the soil, greatly increases its water holding capacity, and promotes the growth of helpful bacteria. The beneficial influence of manure can be seen for two or three years after spreading on the land.

The blackland farmer, considering that commercial fertilizers do not give satisfactory results, must take advantage of legumes and barnyard manure to improve the soil. He must first protect his rolling land by terracing and strip-cropping, use a legume in the rotation, and spread all available manure on the land.

DISCUSSION OF SEVERAL LEGUMES

Hairy Vetch

Hairy Winter Vetch is the hardiest of all vetches, a nitrogen gatherer and a soil improver. It grows fairly well even on poor land, makes good hay or can be grazed and turned under to improve the soil. Vetch grows slowly and is usually late in making a heavy growth. For this reason it should not be turned under until March or April, which is too late to be followed with a cotton or corn crop. It is possible that it

could be followed by cane or hegari in the summer, should moisture conditions be favorable. Vetch may be grazed through the winter and then stock taken off in February and the vetch allowed to mature. Vetch is sometimes planted with oats, rye, etc., if it is to be used for pasture purposes.

Vetch seed must be inoculated with nitrogen-fixing bacteria unless peas or vetch have been grown on the land in the past two years. Read carefully the instructions on inoculant container furnished by the Soil Erosion Service.

Plant from September to December.

Sow 40 lbs. per acre when planting alone, or 25 lbs. per acre when sowing with small grain for grazing purposes. Seed furnished by the Soil Erosion Service must be planted alone so that the seed may be harvested. Vetch may be sown with seeder attachment to the grain drill, or sown broadcast and harrowed into the soil. The amount of seed furnished the farmer must be returned to the Soil Erosion Service after harvest, unless there should be a crop failure.

Austrian Winter Peas

The Austrian Winter Pea is closely related to the garden pea, but is of a sturdier growth and extremely cold resistant. It will grow more rapidly than Vetch and when turned under should decay more rapidly. We believe, in the blackland, one would have a better chance to follow Peas with another crop than one would with Vetch, as it can be turned under earlier in the spring. Winter Peas under favorable conditions should make heavier tonnage than Vetch, which makes it an excellent soil builder.

Austrian Winter Peas must be inoculated unless Vetch or Peas have been previously grown on the land in the last two years.

Plant from September to November.
Sow 50 lbs. per acre when broadcasting for grazing.
Sow 30 lbs. per acre when planting in rows or when sowing with small grain, as described under Vetch.

The Soil Erosion Service recommends planting seed furnished to the farmers in 18 inch rows. The seed are to be harvested and the amount furnished the farmer returned to the Soil Erosion Service, unless there should be a crop failure.

Hubam Clover

Hubam is the annual white-flowering sweet clover. It grows more rapidly than the bi-ennial the first year. It can be used both for pasture and hay. The Soil Erosion Service is anxious to give the Hubam a thorough trial as a winter legume, believing it will withstand ordinary winters and will not die so badly as the white bi-ennial sweet clover in the summer. It can, however, be planted in either the fall or spring. Hubam is a heavy yielder and is practically the same in food value and chemical analysis as the white bi-ennial.

Sow from September to November.
Hubam must be inoculated. Read carefully instructions on inoculant container.
Sow 15 lbs. per acre.

The crop planted from seed furnished by the Soil Erosion Service must be harvested, and unless there is a crop failure the amount of seed furnished must be returned to the Soil Erosion Service.

Now Is The Time To Plant Winter Legumes.

Farmers interested in Vetch, Clover or Austrian Winter Peas should notify the Soil Erosion Service immediately, using attached card or by calling at the office.

Although a large number of farmers have been personally contacted, it has been impossible to see all who might be interested in securing these seed. There is still some seed left for distribution.

The farmers who "strip crop" or "field strip" will be furnished free enough Hairy Vetch, Austrian Winter Peas or Hubam Clover to sow 2 to 5 acres. When the seed crop is harvested they should have enough to plant a larger acreage next year.

The crop planted from seed furnished by the Soil Erosion Service must be harvested and unless there is a crop failure the amount of seed furnished must be returned to the Soil Erosion Service.

SOILS

The Elm Creek Watershed lies within the Black Land Prairie region of Texas, commonly called the Black Waxy lands. This region extends from the Red River on the North almost to San Antonio on the South, a length of about 300 miles. The width varies from about 20 miles in the South to about 75 miles in the North. The total area is about 9,000,000 acres, and includes all or part of 30 counties. The soil and climatic conditions found on the Elm Creek Watershed are representative of the huge area of the best agricultural lands in the state.

The topography of this region is gently undulating to rolling, and was once covered with a dense growth of native bunch and short grasses which effectively controlled erosion. Now, however, probably 80% of this area is in cultivation and is very susceptible to erosion. The average rainfall is about 34 inches per year, and is not well distributed. The action of the almost torrential rains on these soils of extremely fine texture has caused severe erosion throughout the region. According to data from the Black Land Experiment Station, an inch of topsoil is lost every six years from cultivated fields with rows running down hill on a 0 to 5% slope. An equivalent soil loss from a 6% or 7% slope would occur in about 4 years.

The Black Land Prairies are residual soils, that is, soils formed from rocks decomposed and disintegrated in place. The underlying rocks, or parent material, vary from Austin chalk to Taylor Marl.

A further discussion of soils of the Black Land Prairie, along with definitions of terms used in describing soils, will follow in a later issue.

RAIN---------TERRACES

AN APPRECIATION

It was good to see so many cooperating farmers in the fields during and after the rains, observing how their terrace systems were working. These men show interest in this work which we sincerely appreciate.

We are glad to see the rain. As well as other good results, it gave our terraces a good test.

We are pleased to see so few breaks caused by the heavy rains near Troy.

A terracing supervisor will be around to go over your terraces with you to locate the low places, low fills and other weak points in your terrace system.

Results of the Rain

Some incompleted terraces were overtopped.
Several terraces were broken at low fills.
A few terraces were broken on account of unopened outlets.
More interest is shown in the work by farmers.
MORE FARMERS ARE SIGNING CONTRACTS.
We are all feeling better.

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Use enclosed card and write us about anything causing trouble.

Terrace Outlets.

Please check all your terrace outlet structures and fill any places that the water ran through a dry weather crack.

Were your terrace outlets dug down so that the water will empty through the spillways?

We have our troubles, too. A load of gravel in the outlet of a terrace caused that terrace to break and break two below it. If this outlet had been open none of the terraces would have broken.

Did your ditch carry water satisfactorily? Some were not deep enough. Let us build our ditches to the size called for and more spillways can be built, and the ditches will work as they should. It would be well to plow the bottom of your ditches between the outlet structures. This plowed dirt will wash out and after a few plowings the ditches will take care of the water adequately.

Do not plow ditches and outlets protected by vegetation.

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Below is a letter we received the other day from an interested County Agent:

Letterhead of-
CO-OPERATIVE EXTENSION WORK
STATE OF TEXAS.

Canadian, Texas.
November 8, 1934.

Dr. H.V. Geib, Regional Director,
Soil Erosion Service,
Temple, Texas.
Dear Dr. Geib:

I am just in receipt of your News Letter No. 5 of the Elm Creek Watershed, Bell County, and have enjoyed every page of this News Letter. Would be pleased to have any succeeding information that you will have relative to this most important Watershed Development Project.

On my way back from the Farmers' Short Course I had the pleasure of visiting several of these farms on which work was being done and on some that were being completed. I am

deeply interested in this work as I was raised in Bell County and my Mother, Mrs. J.M. Cantrell, 10 miles N.E. of Temple is now on a farm that the Cantrell family have been living on since 1891.

I have been in County Agent work since 1917 and have done a great deal of terracing, having used in the construction of the terrace lines every implement from the plow, V-drag, Road Graders, Terracing machines and the County Road machinery. The work being done in Bell County on this Elm Creek Watershed is the best work that I have ever seen and of the most constructive benefit for lasting results. And I am hopeful that every farm in the Elm Creek Watershed will be terraced in this important project and development. How I wish that every farmer could see and know the importance of this work and the value to the farm now, and what it will mean in the years to come.

Many of the farms that have these ravages of erosion on them now, I saw them when the land was level and the natural soil was from one and one-half feet to seven feet deep and the farmers then told us that the land would never wear out. But alas, how these lands on this Elm Creek Watershed have deteriorated in the last forty years! And what will the next forty years bring to each and every farm that does not take steps to control the great loss of the soil, which is the most fertile in Texas.

Beg your pardon for this lengthy letter, as interested as I am in the conservation of the Soil I wanted to congratulate you and others who

have made it possible to carry out this important work on the Elm Creek Watershed Development, I am .

Very truly yours,

s/ H.M. (Murphy) Cantrell
County Agent

PROGRESS REPORT AS OF OCTOBER 31, 1934.

1. Soil erosion control practices have either been completed or are under process of completion on 371 farms.

2. 1,978,236 feet of terrace lines were run during the month of October. Total feet of terrace lines run up to October 31st, 7,074,180.

3. 1,100,163 feet of terraces were constructed during the month of October. Total feet of terraces constructed up to October 31st, 3,004,125.

4. 274 permanent or temporary dams and spillways were constructed for gully control and terrace outlet protection during the month of October. 1,660 dams of all types have been built to October 31st. 500 E.C.W. men from the Temple Camp, S.E.S. T-1 and the Troy Camp, S.E.S. T-2 are used in the construction of these dams.

5. Farmers have agreed to contour furrow 955 acres of pasture land, and 391 acres have actually been contour furrowed.

6. 150 small graders and 115 fresnoes are now in use in the construction of terraces, and work is being done on 371 farms.

   Of the above number, 25 fresnoes and 10 graders are farmer owned, the remainder being furnished by the Soil Erosion Service.

   In addition to the small graders, nine large type road graders from Bell, Milam and Falls Counties are being used.

7. Economic surveys on 68 farms were made during October. Economic surveys on 155 farms have been completed to October 31st.

8. 699 acres of eroded land have been retired from cultivation and converted into permanent pasture.

9. 47 terrace outlets were seededor sodded during October.

10. 6 ditches were sodded during the month of October.

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We are pleased to announce the appointment of Olen L. Fenner as Extension Agent for the Elm Creek Project. Mr. Fenner is a graduate of Texas A.&M. College and has had several years experience as teacher of vocational agriculture at Gatesville, Texas and Brownwood, Texas.

EXPERIMENT PLOT #3 COMPLETED

On the W.O. Johnson farm near Moody was installed an S.E.S. erosion experimental box. This box was installed to determine the soil and water loss from a field which has no erosion control. The drainage area of the field is 8.1 acres, the slope varying from 0 to 5%. The box was installed at the lower side of the plot to catch all soil and water losses.

The concrete box installed to catch the silt is 60 ft. by 20 ft. by 5½ ft. At the lower end of the box and in front of the spillway there is a 3 ft. concrete dam to hold back the heavy silt. 4 ft. behind this dam there is a 4 ft. wooden floating dam to catch trash that might interfere with calculating the total runoff. On either side of the floating dam are screen meshes to catch the finer trash. The spillway or weir over which the water flows is 15 inches below the sidewalls of the box.

The water flowing over the weir passes through 23 slots 6 by 12 inches in size. Water passing through two of the slots, which is 2/23 of the total water, is led through two divisor boxes with weirs in series and equipped with 13 and 7 slots respectively. The final aliquot, or fraction of the total water running out of the concrete box, is then caught in a tank. Thus the exact amount of the water and the soil in suspension from the field can be determined.

Although the oats in this field were 3 inches high, the 2.72 inch rain of November 15th caused a loss of 22,263.9 lbs. of dry soil, or 11.13 tons. This means that 1.37 tons were lost per acre.

TEXAS LAND MEASURE

Unit of measure: The vara--33 1/3 inches.

36 varas--100 ft. 1900.8 varas--one mile--5280 ft.
5645.4 square varas--one acre--43,560 square ft.

One league
5,000 varas square--4,428.5 acres--13,889 feet square

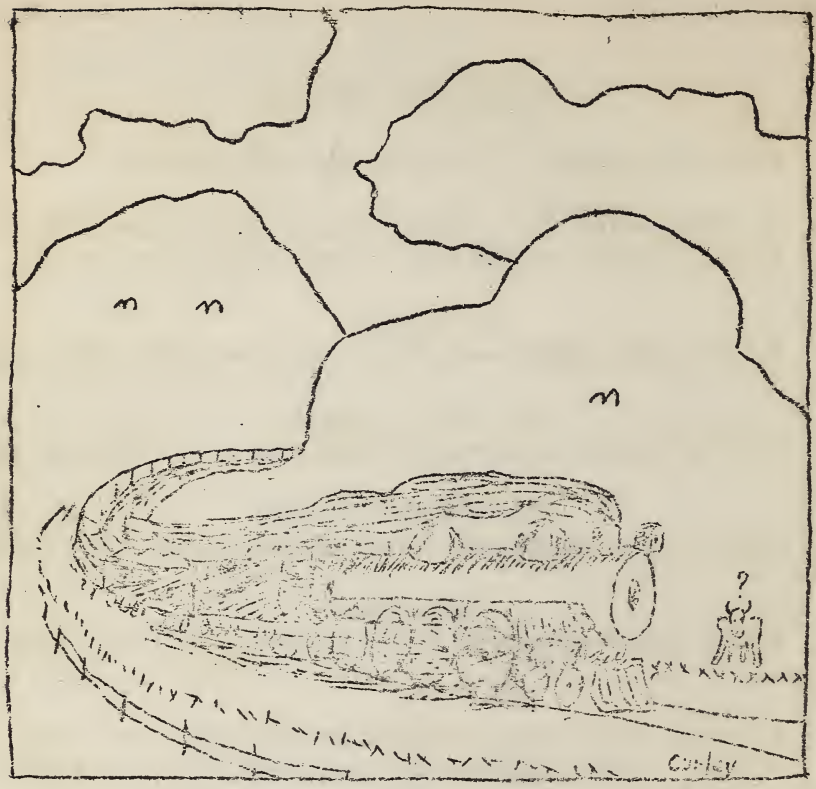
One Third League
2,886.7 varas square--1,476.1 acres--8,019 feet square

One Quarter League
2,500 varas square--1,107.1 acres--6,944 feet square

One Labor
1,000 varas square--177.1 acres--2,778 feet square

1,900.8 varas square--640 acres--5,280 feet square
1,344 varas square--320 acres--3,733 feet square
950.4 varas square--160 acres--2,640 feet square

To reduce varas to feet:
multiply by 100, divide by 36.
To reduce feet to varas:
multiply by 36, divide by 100.
To reduce square varas to acres:
multiply by 177, divide by 1,000,000.
To reduce square feet to acres:
multiply by 23, divide by 1,000,000.



Stop that train!

A freight train reaching thirty-seven times around the circumference of the earth would be required to transport all of the soil that is washed from the American continent every year.